LGC ARMI

ISO Certified · 9001 · 17025 · 17043 · 17034

Certificate of Analysis
IARM Ni718P-18

Additive Manufacturing Powder (-270M+16µ) Nickel Alloy 718 / UNS N07718

Certified Reference Material

Certified Values listed in wt.% with associated uncertainties

Al	0.49 ± 0.02	**C**	0.036 ± 0.003	**Co**	0.097 ± 0.006	**Cr**	19.6 ± 0.2
Cu	0.018 ± 0.004	**Fe**	17.0 ± 0.3	**Mn**	0.026 ± 0.002	**Mo**	3.13 ± 0.04
N	0.010 ± 0.007	**Nb**	4.95 ± 0.08	**Ni**	53.6 ± 0.3	**O**	0.014 ± 0.002
P	0.006 ± 0.003	**S**	0.0013 ± 0.0004	**Si**	0.036 ± 0.009	**Ta**	0.006 ± 0.005
Ti	1.01 ± 0.01	**V**	0.017 ± 0.003	**W**	0.010 ± 0.005		

Indicative Values listed in ppm

Ag (<5)	As (<100)	B (7)	Ca (<50)	Cd (<80)	H (<10)	Hf (<20)
La (<5)	Mg (<50)	Pb (<200)	Pd (<10)	Sb (<100)	Se (<50)	Sn (<50)
Y (<10)	Zn (<100)	Zr (<30)				

Description and Intended Use

This **Certified Reference Material** is covered under the scope of accreditation to **ISO 17034** by LGC Standards - Manchester, NH. As an ISO 17034 certified reference material, appropriate use of this material will fulfill the certified reference material and traceability requirements for use in **ISO 17025** certified laboratories. This CRM will come in the form of powder. The intended use of this CRM may include, but is not limited to, the calibration of instruments and the validation of analytical methods. The following particle size distribution is provided by the manufacturer and should be used for information only.

Test	Units	Result
Mesh +200	wt %	0
Mesh +230	wt %	0
Mesh +270	wt %	0.6
Microtrac -16µ	volume %	0.3
Flow Rate	sec/50g	16.3

Instructions for Use

1. The minimum sample size should be individually evaluated based on the analytical technique used; this would typically be greater than 0.1 grams.
2. The material should be stored in a cool, dry location when not in use.

The following data represents all pertinent information reported as it applies to the chemical characterization of this material.

	Al	C	Co	Cr	Cu	Fe	Mn	Mo	N	Nb	Ni	O	P	S	Si	Ta
1	0.449	0.0287	0.087	19.1605	0.012	16.54	0.021	3.0166	0.0004	4.7878	53.026	0.00979	0.002	0.00064	0.02	0.00185
2	0.4668	0.03057	0.092	19.39	0.013	16.55	0.023	3.093	0.00344	4.795	53.24	0.0123	0.0032	0.00088	0.021	0.0032
3	0.471	0.034	0.093	19.41	0.0137	16.97	0.025	3.095	0.0063	4.9231	53.50	0.014	0.00369	0.001	0.0216	0.004
4	0.478	0.035	0.0932	19.5037	0.016	16.98	0.025	3.11	0.0073	4.94	53.728	0.014	0.004	0.0012	0.028	0.005
5	0.486	0.0372	0.094	19.504	0.017	17.008	0.0258	3.1308	0.0081	4.97	53.86	0.0145	0.004	0.0013	0.03577	0.0054
6	0.50	0.0373	0.095	19.56	0.018	17.20	0.0259	3.143	0.0111	4.98	53.89	0.0145	0.00507	0.00168	0.036	0.006
7	0.50	0.0375	0.09813	19.59	0.019	17.253	0.026	3.16	0.01668	4.986	53.92	0.0161	0.011	0.002	0.045	0.019
8	0.505	0.0378	0.099	19.60	0.0197	17.39	0.026	3.16	0.027	4.987		0.018	0.012	0.002	0.0461	
9	0.51	0.038	0.1095	19.71	0.0231		0.0262	3.179		4.99					0.05	
10	0.5121	0.0432	0.112	20.29	0.029		0.032	3.18		5.16					0.052	
11																
Mean	0.49	0.036	0.097	19.6	0.018	17	0.026	3.13	0.01	4.95	53.6	0.014	0.006	0.0013	0.036	0.006
STDV.	0.02	0.004	0.008	0.3	0.005	0.3	0.003	0.05	0.008	0.1	0.4	0.002	0.004	0.0005	0.01	0.006
Certified	**0.49**	**0.036**	**0.097**	**19.6**	**0.018**	**17.0**	**0.026**	**3.13**	**0.010**	**4.95**	**53.6**	**0.014**	**0.006**	**0.0013**	**0.036**	**0.006**
U_{CRM}	0.02	0.003	0.006	0.2	0.004	0.3	0.002	0.04	0.007	0.08	0.3	0.002	0.003	0.0004	0.009	0.005
Methods	I	C	I,IM	I,W	I,IM	I	I,IM	I	F	I	I,IM	F	I,IM	I,C	I,IM	I,IM

	Ti	V	W	Ag	As	B	Ca	Cd	H	Hf	La	Mg	Pb	Pd	Sb	Se
1	0.99	0.01433	0.001	<0.0005	0.00008	0.00029	0.004	0.0079	0.0002	<0.001	<0.0005	0.00006	0.00004	<0.001	0.00006	0.0011
2	0.99	0.015	0.008		0.00075	0.0007	<0.0005	<0.001	0.0003	<0.002		0.0005	0.0212		0.0001	<0.001
3	0.996	0.015	0.00917		0.0017	0.0007	<0.001	<0.002	0.00053			<0.001	<0.001		0.0045	<0.005
4	0.9963	0.016	0.01015		0.00919	0.00074	<0.005	<0.005	0.001			<0.001	<0.001		<0.001	<0.005
5	1.00	0.017	0.011		<0.001	0.0012	<0.005					<0.001	<0.001		<0.001	
6	1.0067	0.02214	0.011		<0.005	<0.001						<0.005	<0.005		<0.01	
7	1.011		0.019		<0.005	<0.001										
8	1.014					<0.001										
9	1.03					<0.005										
10	1.05															
Mean	1.01	0.017	0.01		0.003	0.0007									0.002	
STDV.	0.02	0.003	0.005		0.004	0.0003									0.003	
Certified	**1.01**	**0.017**	**0.010**	**(<0.0005)**	**(<0.01)**	**(0.0007)**	**(<0.005)**	**(<0.008)**	**(<0.001)**	**(<0.002)**	**(<0.0005)**	**(<0.005)**	**(<0.02)**	**(<0.001)**	**(<0.01)**	**(<0.005)**
U_{CRM}	0.01	0.003	0.005													
Methods	I	I,IM	I,IM	IM	I,IM,A	I,IM	I,IM	I,IM	F	IM	IM	I,IM	I,A,IM	IM	I,IM,A	I,IM,A

	Sn	Y	Zn	Zr
1	0.000273	<0.0005	<0.001	0.000643
2	0.0004	<0.001	<0.001	0.00096
3	0.00054		<0.005	0.00277
4	<0.001		<0.01	<0.001
5	<0.001			<0.001
6	<0.001			<0.001
7	<0.005			<0.002
Mean	0.0004			0.001
STDV.	0.0001			0.001
	(<0.005)	**(<0.001)**	**(<0.01)**	**(<0.003)**
Methods	I,IM,A	IM	I,IM	I,IM

Legend: W = Classical, C = Combustion, F = Fusion, A = AA or GFAA, I = ICP or DCP, IM=ICP-MS, D = DC Arc, O = AES, X = XRF, G = GDAES or GDMS, H = Hollow Cathode AES

Certification Laboratories

Applied Technical Services, Inc.	Marietta, GA	Connecticut Metallurgical, Inc.	East Hartford, CT
Dirats Laboratories	Westfield, MA	EAG Laboratories, Inc.	Liverpool, NY
IMR Test Labs	Lansing, NY	Laboratory Testing, Inc.	Hatfield, PA
LGC Standards	Manchester, NH	Luvak Laboratories	Boylston, MA
Massachusetts Materials Research, Inc.	West Boylston, MA	NSL Analytical Services, Inc.	Cleveland, OH
SGS MSi	Melrose Park, IL		

Certification laboratories have demonstrated performance and traceability by utilizing a variety of test methods all under the scope of ISO 17025. Some of the specific CRMs and SRMs used in the analysis of the material covered by this certificate are:

IARM 56A   IARM 6D   IARM 55A   NBS 184   NBS 856

Homogeneity and Uncertainty

"Uncertainty" values, as reported adjacent to certified concentration values, are based on a 95% Confidence Interval. These estimated uncertainties include the combined effects of method imprecision, material inhomogeneity, and any bias between methods. Homogeneity data from experimental ICP results are reflected in both the overall statistics and certified data. Homogeneity samples are selected by a systematic sampling procedure. The number of samples may be determined by equation 1, where N_{prod} is the number of units produced and N_{min} is the number of samples used for homogeneity testing. These samples are arranged in a simple randomized design such that each sample is analyzed multiple times by ICP. Homogeneity may also be determined within sample using an applied version of ASTM E826. A single factor ANOVA is used to calculated uncertainty due to inhomogeneity (U_{hom}). Uncertainty of the material is calculated by equation 2, where H=U_{hom}, S= Standard deviation, t= t-value at 95% CI, and n= number of observations.

$$1. \quad N_{min} = \max(10, \sqrt[3]{N_{prod}})$$

$$2. \quad U_{CRM} = \frac{\sqrt{H^2 + S^2}}{\sqrt{n}} * t$$

Expiration

The certification of this material is valid indefinitely, within the uncertainty specified, provided the material is handled and stored in accordance with the instructions stated on this certificate. The certification is nullified if the material is damaged, contaminated, otherwise modified, or used in a manner for which it was not intended.

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Analytical Reference Materials International